TOWARD A MECHANISTIC UNDERSTANDING OF THE TENDENCY TO INFER *OUGHT* FROM *IS*: THE ROLE OF BIASES IN EXPLANATION

BY

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THESIS

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Abstract

People tend to judge what is typical to be also good and appropriate—what one ought to do. What accounts for the prevalence of these judgments, given that their validity is at best uncertain (Hume, 1740/2000)? We hypothesized that the tendency to reason from *is* to *ought* is due in part to a systematic bias in people's (nonmoral) explanations, whereby regularities (e.g., giving roses for Valentine's Day) are explained predominantly via inherent or intrinsic facts (e.g., roses are beautiful). In turn, these inherence-biased explanations license downstream, value-laden conclusions (e.g., it's *good* to give roses). Consistent with this proposal, 4 studies (*N* = 517 children and adults) suggested that the inherence bias in explanation fosters, from an early age, inferences that imbue observed reality with value. Given that explanations fundamentally determine how people understand the world, the inherence bias in these judgments is likely to exert substantial influence over sociomoral understanding.

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Chapter 1

Introduction

In his dissent with the recent Supreme Court decision to make marriage a constitutional right (thereby allowing gay couples to marry), Chief Justice Roberts argued that heterosexual marriage has been around "for millennia" in societies all over the world: "the Kalahari Bushmen and the Han Chinese, the Carthaginians and the Aztecs" (Obergefell v. Hodges, 2015). A possible reading of this remark is that we should take what is *typical* as a signpost for what is *good*—how things *ought to* be.[1] Whatever the correct interpretation here, the tendency to move seamlessly from *is* to *ought* is a mainstay of everyday reasoning (Hume, 1740/2000; for a review, see Eidelman & Crandall, 2014). Note, however, that the validity of such is–ought inferences is at best uncertain. The mere existence of a pattern of behavior does not, in and of itself, reveal that people ought to behave that way or that the behavior is good: Think of slavery, for instance, or child labor. Both were common throughout history. Why, then, do people draw these inferences so readily and find them so persuasive?

Our goal here is to identify the psychological underpinnings of this tendency—an issue that is largely unexplored. We propose that the permeable boundary between *is* and *ought* is, in part, a byproduct of the basic processes that underlie explanation. Across development, everyday explanations are often generated off the cuff rather than via careful deliberation (e.g., Cimpian & Salomon, 2014a,b; Wilson & Keil, 1998). The heuristic nature of this process gives rise to systematic bias in the explanations generated, ultimately leading people to overestimate

[1] Alternatively, this could be a Burkean argument about the value of institutions that have withstood the test of time (Burke, 1790/2012).

the extent to which the phenomena being explained ought to be that way.[2] We detail this proposal below, before describing the four studies that tested it.

The Explanatory Roots of Is–Ought Inferences

The motivation to make sense of one's experiences is present even in infants (e.g., Baillargeon, 1994; Saxe, Tenenbaum, & Carey, 2005). Many of the phenomena we observe are complex, however, and our cognitive systems are limited in many respects that affect explanation (e.g., retrieval from long-term memory is fallible; working memory capacity is highly constrained). By necessity, then, people must settle for "good enough" when coming up with explanations (Cimpian & Salomon, 2014a,b; Thomas, Dougherty, & Buttaccio, 2014; Wilson & Keil, 1998), as they do with respect to other judgments (e.g., Kahneman, 2011; Shah & Oppenheimer, 2008; Stanovich & West, 2000). That is, people often take whatever information they can retrieve on the spot and use it to assemble a *heuristic* explanation—an explanation that, while not guaranteed to be accurate, seems intuitively plausible.

The fact that everyday explanations tend to be based on information that's easily retrieved has an important corollary: Any systematic biases in the content of this most-accessible information are likely to also bias the explanations generated. Relevant to this argument, when retrieving information about an entity, the information that comes to mind first tends to concern the entity itself (hereafter, *inherent* information) rather than its context, its history, or its relations with other entities (hereafter, *extrinsic* information) (e.g., Ashcraft, 1978; Hussak & Cimpian, 2014; McRae, Cree, Seidenberg, & McNorgan, 2005). For example,

[2] Is–ought inferences are sometimes confused with the *naturalistic fallacy* (Moore, 1903), which is the (conceptually distinct) assumption that what is *natural* is also good. The naturalistic fallacy is beyond the scope of this research.

when thinking about roses, people may immediately retrieve inherent facts such as that roses have a beautiful look and a sweet smell. In contrast, extrinsic facts about roses that are also available in memory (e.g., that flower shops sell them year-round) are seldom among the first retrieved.

This retrieval bias leaves its mark on the process of generating explanations, skewing the output of this process toward inherence (Cimpian, 2015; Cimpian & Salomon, 2014a,b). For example, when wondering why roses are a typical gift for Valentine's Day, an intuitive answer might appeal to their beautiful look. However, this easy inherent explanation[3] would miss the mark. The actual reason we buy roses on Valentine's Day has more to do with the fact that, as Valentine's Day grew in popularity, businesses needed a flower that could be imported in bulk from remote countries with milder February temperatures (*NPR*'s *Planet Money*, February 13, 2015). The contrast between the more intuitive answer and the actual (largely extrinsic) explanation for the association between roses and Valentine's Day illustrates the broad inherence bias that characterizes heuristic explanations—a bias for which there is considerable experimental evidence in both children and adults (e.g., Cimpian & Steinberg, 2014; Hussak & Cimpian, in press; Salomon & Cimpian, 2014; Sutherland & Cimpian, in press).

But why would this inherence bias lead to the impression that the things being explained ought to be that way? A plausible mechanism involves intuitions that, while not part of the explanation process per se, are likely to form downstream of it. When a phenomenon is explained via inherent features, it often acquires an aura of obviousness, even necessity: "*Of*

[3] In this case, an *inherent* fact about roses (i.e., their appearance) is used to explain an *extrinsic* fact about them (i.e., that they are given as gifts for Valentine's Day). The converse is also possible, as are inherent/inherent and extrinsic/extrinsic combinations. However, the facts used to explain may be inherent more often than warranted.

course we choose roses for Valentine's Day," one might reason. "They have the perfect look. It couldn't have been any other way." In turn, if roses are the obvious choice, then it is reasonable to also conclude that people *ought* to give roses (rather than other flowers)—that it's a *good* thing to do. In contrast, extrinsic explanations of a phenomenon are less likely to license such value-laden conclusions because they tend to highlight the contingent (vs. necessary) nature of the explanandum—they reveal how things could have easily turned out otherwise. If, for example, one's explanation takes into account the historical transformation of Valentine's Day into a business opportunity, it may not seem necessary that we give each other roses for this holiday, nor particularly desirable. Thus, the inherence bias in explanation may foster is–ought inferences in part because inherent explanations are often accompanied by additional intuitions about necessity ("it has to be this way") and, subsequently, obligation ("one ought to do it"). Note that neither of these inferential links is claimed to be deterministic—there will undoubtedly be exceptions. We propose that explanations that rely exclusively on inherent facts are generally more likely than explanations that include extrinsic elements to foster additional intuitions about how things couldn't have been otherwise, which then often give rise to value-laden judgments.[4]

Theoretical Contribution and Relation to Prior Work

The explanation-based mechanism outlined here provides a means of accounting for the remarkable extent to which people's ideas about *should* and *ought* mirror what they happen to observe around them. Moreover, given that explanations are the primary vehicle through which humans understand the world (e.g., Keil, 2006; Lombrozo, 2012), a bias in these

[4] To be clear, it is the inherent vs. extrinsic nature of the *explanation* for a fact—not of the fact itself—that is hypothesized to influence the likelihood of is–ought inferences.

judgments is likely to exert a deep influence on sociomoral reasoning. This proposal adds a unique perspective to current theories concerning the sources of value in people's sociomoral judgments (good/bad, right/wrong, etc.). For instance, prior research has suggested that people's evaluations of others' actions are also influenced by skeletal principles evolved via natural selection (e.g., Graham et al., 2013; Hamlin, Wynn, & Bloom, 2007; Sloane, Baillargeon, & Premack, 2012), domain distinctions constructed through early interactions with others (e.g., Helwig & Turiel, 2011; Smetana, 2006), and explicit knowledge acquired through socialization and enculturation (e.g., Dahl & Campos, 2013; Shweder, Mahapatra, & Miller, 1987). According to our proposal, the explanatory bias under investigation here is an independent source of sociomoral value that works in tandem with other such sources to shape how people understand what is appropriate and right.

To clarify, our account goes beyond simply asserting a relation between explanations and sociomoral reasoning. Such a relation is featured, although somewhat implicitly, in prior accounts. For instance, social domain theorists have argued that people's "informational assumptions"—roughly, how they make sense of a certain phenomenon, such as abortion or homosexuality—influences their evaluation of that phenomenon (e.g., Turiel, Hildebrandt, & Wainryb, 1991; see also Eidelman & Crandall, 2014). In contrast, here we propose and test the causal influence of a specific key aspect of explanatory reasoning (namely, its inherence bias) on sociomoral reasoning across development. On our view, this bias is essential to a mechanistic understanding of is–ought inferences, and it also provides a new perspective on the development of sociomoral judgment more generally.

Predictions

We tested three predictions of the present proposal. First, we tested whether the inherence bias in participants' explanations predicts their tendency to make is–ought inferences (Study 1). Second, we tested whether this relationship is causal by experimentally manipulating the bias in participants' explanations and measuring downstream effects on their is–ought inferences (Study 3). Third, we tested whether these predictions hold for children as well (Studies 2 and 4). Everyday explanations are inherence-skewed even in children (e.g., Cimpian & Steinberg, 2014), which suggests that this explanatory bias might foster is–ought inferences throughout development. Evidence for developmental continuity in this respect would also suggest that explanatory biases have ample opportunity to shape sociomoral understanding.

Chapter 2

Study 1

In Study 1, we tested whether adult participants' preference for inherent explanations predicts the extent to which they infer *ought* from *is*.

2.1 Method

Participants. The participants (N = 122; M_{age} = 37.2; SD = 13.0; 43 men, 88 women) were recruited from Amazon's Mechanical Turk service. Participants received $0.75 for participation. Nine additional participants were tested but excluded because they had IP addresses from outside the United States (n = 2) or because they failed the catch questions embedded in the explanation measure (n = 7; see below for detail). The sample size and data-collection stopping rule for this study, as well as subsequent ones, were determined with a power analysis using effect sizes from studies on related topics (e.g., Hussak & Cimpian, in press; Salomon & Cimpian, 2014; Sutherland & Cimpian, in press).

Materials. To test our prediction, we devised measures of participants' (1) tendency to draw is–ought inferences and (2) preference for inherent explanations. The study also included four control measures (assessing education, fluid intelligence, and political orientation), as described below.

***Is–Ought Inferences*.** Participants read six passages structured like press releases, and modeled on actual press releases, that described a widespread societal practice (i.e., what *is*). For example, one was titled "America's pizza obsession: By the numbers" and read as follows:

> The quintessential American food may be apple pie, but its popularity pales beside our national love affair with pizza pies. *The Daily* reports that Americans consume a

staggering 100 acres of pizza a day, according to data from the National Association of Pizza Operators (NAPO).

Over $38 billion of pizza is sold in America annually, according to *Pizza Today*, and 3 billion pizzas are sold in the U.S. each year according to NAPO. 350 slices of pizza sold every second, according to NAPO, and the average American eats an average of 46 slices of pizza year, according to *Packaged Facts*. Overall, a total of 94% of Americans eat pizza.

After reading each press release, participants were asked five questions: one is–ought question (e.g., "Do you think it should be that so many Americans eat pizza?"; 1 = "definitely no" to 9 = "definitely yes") and four fillers that served to camouflage the main focus of the study (e.g., "Do you think the amount of pizza sold will grow in the next 5 years?", "What do you think accounts for the current prices of pizza?"). Three of the press releases were accompanied by a *should* question, as illustrated above, and the other three were accompanied by a *good* question (e.g., "Do you think that it's good that so many Americans drive to work?" [1 = "really not good" to 9 = "really good"] after a passage claiming that 88% of Americans drive to work).

It is worth noting that the press releases were purposely about behaviors that fall outside the scope of most existing accounts of sociomoral reasoning (eating pizza, driving to work, drinking coffee, owning a TV, using email, and watching football) so as to illustrate the unique contribution of our account. All passages were factual in tone, without evaluative language, to avoid influencing participants' normative judgments (see Appendix for full text).

Responses to the six is–ought questions were averaged into a composite (α = .58; lowest item-total correlation = .33) that served as our main dependent variable. (Notably, the results

reported below remained the same when excluding the item with the lowest item-total correlation.)

***Bias toward Inherent Explanations*.** Fifteen items were used to assess the extent to which participants preferred explanations in terms of inherent facts (e.g., "Black is associated with funerals because of something about the color black or about funerals—maybe because the darkness of black conveys how people feel at funerals"; $\alpha = .85$; lowest item-total correlation = .47; see Table 1 for other sample items). All items were scored using nine-point scales (1 = "disagree strongly" to 9 = "agree strongly") and were presented in a random order. Note that, as with the Is–Ought measure, the items in the Inherent Explanations measure were worded factually and did not contain evaluative language. Two catch items were included to detect inattention (e.g., "Please click on the number three below to indicate that you are paying attention"). Participants who missed either of these catch items were excluded ($n = 7$).

***Control Measures*.** Four control measures were administered to investigate alternative explanations for the predicted relationship between participants' explanations and their is–ought inferences. These measures tap into dimensions that could potentially influence both variables of interest, giving rise to a correlation between them in the absence of a causal relationship. First, we measured participants' level of education (1 = "Less than high school" to 6 = "Doctoral (Ph.D., J.D., M.D.)"). Second, we measured their fluid intelligence with 12 Raven's Progressive Matrices (Raven, 1960; see also Salomon & Cimpian, 2014). Third, we measured participants' political views ("How would you describe your political attitudes?"; 1 = "Strongly liberal" to 9 = "Strongly conservative"). Fourth, related to the measure of conservatism, we assessed participants' belief in a just world (e.g., "Basically, the world is a just place"; Rubin &

Peplau, 1975).

Procedure. Participants were tested online via Qualtrics (Qualtrics Labs Inc., Provo, UT). The Is–Ought measure, the Inherent Explanations measure, the Belief in a Just World scale, and the Raven's Progressive Matrices were presented in random order. Item order was randomized for all scales except the Raven's Progressive Matrices, which were presented in increasing order of difficulty. The measures of participants' education and political views were administered at the end of the sessions, along with other demographic questions. Finally, participants were debriefed.

2.2 Results

As predicted, the extent of the inherence bias in participants' explanations was significantly correlated with their tendency to draw is–ought inferences, $r(120) = .30$ [.13, .46], $p < .001$. Moreover, this relationship remained significant even when statistically adjusting for participants' education, fluid intelligence, conservatism, and belief in a just world in a multiple regression, $\beta = .31$ [.12, .49], $p = .001$. None of these other variables approached significance, $|\beta s| < .11$, $ps > .25$ (see Table 2 for full regression results).

The results of Study 1 suggest that the inherence bias in participants' explanations accounts for unique variance in their likelihood of drawing is–ought inferences, above and beyond a number of control variables such as their education, intelligence, and political views. Study 2 investigates whether this relationship is present in children's thinking as well, which would suggest that it plays a part in the development of sociomoral thought.

Chapter 3

Study 2

3.1 Method

Participants. The participants were 80 children aged between 4 and 7 (M_{age} = 5.98 years, *SD* = 1.13; 40 girls and 40 boys) who were recruited from a small city in the Midwestern United States. We sampled 4- to 7-year-olds to be able to draw conclusions about a relatively broad stretch of development, as well as ensure that we would see sufficient variability in children's sociomoral and explanatory reasoning (e.g., Cimpian & Steinberg, 2014). Six additional children were tested but excluded from the final sample because they refused to complete the study. The children were mostly European American and represented a variety of socioeconomic backgrounds.

Materials and Procedure. As in the preceding adult study, our main measures concerned children's (1) tendency to draw is–ought inferences and (2) preference for inherent explanations. The order of these measures was counterbalanced across participants. Between the measures, children completed a 1-minute distractor task (coloring) that served to maintain their engagement and minimize interference between the two sets of questions.

***Is–Ought Inferences*.** Children were read a mock newspaper featuring four facts familiar to young children (e.g., money is green; see the Appendix). After reading a fact from the newspaper, the experimenter asked children three is–ought questions pertinent to that fact: (1) whether the fact was "good," (2) whether it was "the way things should be," and (3) whether it would be "bad" if things were otherwise (see the Appendix). The *good* question was measured on a four-point scale ("no," "sort of good," "good," and "really good"); the *should* question

required a "yes" or "no" response; the *bad-if-otherwise* question was measured on a four-point scale ("no," "sort of bad," "bad," "really bad"). The order of the newspaper facts and the is-ought questions was counterbalanced across children. Children's responses to these three questions were converted to a common 0–1 scale, with higher scores indicating stronger is–ought intuitions, and then averaged into a composite (α = .58; lowest item-total correlation = .52; *M* = .66, *SD* = .23).

***Bias toward Inherent Explanations*.** We used a broad measure of children's explanatory preferences, adapted from prior work on this topic (Cimpian & Steinberg, 2014; Sutherland & Cimpian, in press). The first item in this measure asked children to evaluate inherent and extrinsic explanations for everyday patterns (e.g., birthday cakes have candles "just because they are birthday cakes" [inherent] or "just because people thought it might be a nice idea" [extrinsic]). Children used a four-point scale to indicate their agreement with these explanations ("really not right," "sort of not right," "sort of right," and "really right").

The other items in this measure tapped intuitions that might *follow* inherent explanations. As discussed in the introduction, inherent explanations often make it appear that the explanandum is necessary (rather than contingent). To assess these downstream intuitions about necessity, we asked children the following:

(1) whether observed facts are *temporally stable* (e.g., "Do you think birthday cakes will always have candles, even way into the future when the last birthday cake is made?"; answer options: "yes" or "no"),

(2) whether observed facts are *inalterable* (e.g., "Imagine if people wanted birthday cakes to not have candles, and everyone agreed that they wanted birthday to not have candles.

Would it be okay to make a change so that birthday cakes do not have candles or would it not be okay?"; answer options: "okay," "sort of not okay," "not okay," and "really not okay"), and

(3) whether words are inherently suited for their referents and thus could not be otherwise (e.g., when people were first coming up with the name for a candle, "…could they have called it something else, like a 'diby' or a 'peara' or did they have to call it a 'candle'?"; see Sutherland & Cimpian, in press). Children could indicate their answer choice either verbally or non-verbally, by pointing to a body part (see Cimpian & Park, 2014, for a previous use of this procedure). Overall, the greater the inherence bias in children's explanations, the more they should think that the phenomena being explained are temporally stable and inalterable.

The questions above were asked about two facts (that birthday cakes have candles, and that coins are round); these facts were different than those used for the Is–Ought measure. Both question order and fact order were counterbalanced across children. Children's answers to these questions (averaged across the two facts) were converted to a common 0–1 scale, with higher scores indicating a stronger inherence bias, and then averaged into a composite ($\alpha = .60$; lowest item-total correlation = .55; $M = .51$, $SD = .24$).

***Control measures*.** Our analyses included two control measures. First, we adjusted for children's chronological age. The inherence bias in explanation declines somewhat with age (Cimpian & Steinberg, 2014), and if the same is true of is–ought inferences, then these two variables could correlate coincidentally, just because they both happen to decline with age. Partialling out children's age also serves to minimize the potential influence of other variables that change with development (e.g., working memory, inhibitory control). Second, since young children may be prone to say "yes" to complex questions of the sort we were asking, we

included a measure of "yes" bias. Specifically, we embedded in the Is–Ought measure a question about whether the relevant patterns (e.g., money being green) were "interesting." This question should be fairly opaque to 4- to 7-year-olds, so it should capture a tendency to say "yes" when unsure of an answer. (Note, however, that several of the questions in the Is–Ought and Inherent Explanations measures were reverse-coded; thus, a "yes" bias would be an unlikely alternative for the predicted correlation even if we didn't adjust for it.)

3.2 Results

Just as we found for the adults in Study 1, children with higher scores on the Inherent Explanations measures were also more likely to infer *ought* from *is*, $r(78) = .45$ [.26, .61], $p < .001$. Moreover, this relationship was not due to coincidental changes with age or to a "yes" bias: Evidence for it was also found in a regression analysis that accounted for these two alternatives, $\beta = .43$ [.21, .65], $p < .001$ (see Table 3 for full regression results). These results also replicated (ps $\leq .024$) when we used a narrower measure of children's explanations—namely, just the item that assessed their agreement with inherent explanations.

Thus, the tendency to explain the world in inherent terms and the tendency to derive *ought* from *is* appear to be linked even among preschoolers. The last two studies tested whether this link is causal by manipulating adults' (Study 3) and children's (Study 4) explanations and measuring subsequent changes in their is–ought reasoning.

Chapter 4

Study 3

4.1 Method

Participants. The participants were 267 adults (M_{age} = 30.5, *SD* = 12.9; 108 men, 158 women, 1 did not report gender) from Amazon's Mechanical Turk service or a university subject pool. Participants were compensated with $0.75 or course credit, respectively. An additional 26 subjects were tested but excluded from the final sample because their IP addresses were from outside the US (*n* = 3), because they failed our catch items (*n* = 21), or because they indicated during debriefing that they had not paid attention (*n* = 2).

Manipulation. We used a manipulation that has previously been found to lower the inherence bias in participants' explanations (Salomon & Cimpian, 2014). This manipulation consisted of a 10-item "scale" whose purpose was not to assess some construct or other but rather to temporarily alter participants' habitual thinking patterns (e.g., Bryan, Dweck, Ross, Kay & Mislavsky, 2009). Participants were randomly assigned to either an Anti-Inherence (*n* = 132) or a Control (*n* = 135) condition. The mock scale in the Anti-Inherence condition was designed to influence participants' explanatory intuitions by exposing them to strongly worded extrinsic explanations (e.g., "We give flowers as gifts for a variety of occasions [e.g., Valentine's Day, funerals] because of effective advertising and marketing by florists—not because flowers effectively convey a variety of sentiments" or "The only reason our paper, money, and books are rectangular is historical happenstance"). To maximize the influence of these extrinsic primes, we also used response scales that were skewed toward agreement (1 = "disagree," 2 = "agree somewhat," 3 = "agree," and 4 = "agree very strongly"). The mock scale in the Control

condition was matched in content but did not contain any explanations (e.g., “People often give flowers as gifts on a variety of different occasions [e.g., Valentine’s Day, funerals]” or “Most books, paper, and money are rectangular in shape”).

Procedure and Materials. Following the manipulation, participants completed a brief distractor task (“Where’s Waldo?”). They then filled out two measures, in randomized order: (1) a check for effectiveness of the manipulation (the Inherence Heuristic Scale; Salomon & Cimpian, 2014), and (2) an Is–Ought measure, which was the same as in Study 1 (α = .63; lowest item-total correlation = .46). At the end of the study, participants completed a demographics questionnaire and a debriefing.

4.2 Results

We predicted that our scale manipulation would lower the extent to which participants’ explanations are inherence-biased, and in turn the likelihood that they would make is–ought inferences.

Manipulation Check. Participants in the Anti-Inherence condition (M = 5.64, SD = 1.23) had lower scores on the Inherence Heuristic Scale than those in the Control condition (M = 6.28, SD = 1.18), $t(265) = 4.29$, $p < .001$, $d = .53$. Thus, our manipulation appears to have been effective in counteracting the inherence bias in participants’ explanatory intuitions.

Effect on Is–Ought Inferences. Consistent with our main prediction, participants in the Anti-Inherence condition (M = 5.45, SD = 1.15) also had lower scores on the Is–Ought measure than those in the Control condition (M = 5.78, SD = 1.19), $t(265) = 2.24$, $p = .026$, $d = .27$. Next, we tested whether the effect of the manipulation on participants’ is–ought reasoning was mediated by its effect on their explanations. Indeed, this indirect effect was significant in a

bootstrapped product-of-coefficients mediation analysis, *ab* = −.07 [−.12, −.03], *SE* = .02 (see Figure 1). In other words, the Anti-Inherence participants' weaker is–ought inferences were due in part to their diminished preference for inherent explanations.

Conclusion. In support of our causal claims, experimentally lowering the extent to which participants relied on inherent facts in their explanations also lowered the extent to which they drew inferences about how things should be based on how they are. In the last study, we tested this causal link in a sample of 4- to 7-year-old children.

Chapter 5

Study 4

5.1 Method

Participants. The participants were 48 children aged between 4 and 7 (M_{age} = 6.07, *SD* = 1.21; 24 girls and 24 boys) who were recruited from a small city in the Midwestern United States. The children were demographically similar to those in Study 2. Seventeen additional children were tested but excluded from the final sample because they refused to complete the study (*n* = 6) or because they failed a comprehension check (*n* = 11; see below).

Manipulation. For a precise test of the causal link between explanation and is–ought inferences, in Study 4 we manipulated how children explained the very same facts about which we later asked them is–ought questions. (By comparison, the manipulation in the previous study was aimed at inherent explanations more globally.) For each of six familiar facts (e.g., that brides wear white at weddings), we first provided children with either an inherent or an extrinsic explanation. The inherent explanations appealed to the inherent features of the entities in the explanandum (e.g., white is really bright), whereas the extrinsic explanations appealed to historical events and processes (e.g., an important queen wore white at her wedding, so then everyone started doing it; see the Appendix for full text). This manipulation was within-subject: three facts received an inherent explanation, and three an extrinsic explanation. The three explanations of the same type were presented as a block, and the order of the inherent and extrinsic blocks was counterbalanced across children.

Main Measures. Following each explanation, children were asked the following questions, in counterbalanced order: (1) the is–ought questions from Study 2 (Is it good that …?

Is it the way things should be? Would it be bad if things were different?; α = .58; lowest item-total correlation = .59), and (2) the inalterability question from Study 2 (If everyone agrees, can it be changed?), which served as a brief manipulation check. Before each of these questions, the experimenter reminded children of the relevant (inherent or extrinsic) explanation.

Attention/Comprehension Checks. To check that children were paying attention and understanding the explanations, the experimenter asked them to recall the explanations (1) immediately after hearing them, and (2) after answering the is-ought and inalterability questions. If a child could not repeat back the explanation right after hearing it, the experimenter read it again. If a child could not recall any portion of the explanation after three prompts by the experimenter, the child was excluded from the sample (*n* = 11).

Control Measures. As before, our analyses adjusted for participants' chronological age. In addition, Study 4 included a "shallow cues" control to test whether the effect of the inherent vs. extrinsic manipulation might be due not to differences in the inherence of the explanations per se but to more superficial aspects of their content or wording (e.g., positive or negative associations children might have with particular phrases). To capture responses based on such shallow cues to positivity vs. negativity, we asked children to rate how "fun" they thought each fact was on a scale from 1 ("really not fun") to 6 ("really fun"). These questions were asked at the very end of the sessions, and children were briefly reminded of the relevant explanation for each fact before answering the "fun" question. This question was administered to a random subset of children (*n* = 22; M_{age} = 5.88, *SD* = 1.08).

5.2 Results

We predicted that extrinsic (vs. inherent) explanations would lead children to view the

facts being explained as less necessary and inalterable, which would in turn weaken children's tendency to make is–ought inferences.

Manipulation Check. Children were less likely to judge the facts as inalterable when they heard extrinsic explanations (M = .44, SD = .37) than when they heard inherent explanations (M = .54, SD = .42), $t(47) = 2.21$, $p = .032$, $d = .25$. This difference also held up when we adjusted for children's chronological age in a multilevel model with random intercepts for subjects and items, β = −.10 [−.18, −.03], $p = .009$. (The multilevel model was necessitated by the repeated-measures nature of the data.) Further, adjusting for both age and the "shallow cues" control in the subsample of children who received this question led to the same conclusion, β = −.12 [−.23, −.01], $p = .036$. These two models also revealed that children's intuitions about the immutability of observed facts decreased with age, βs = −.40 [−.59, −.21] and −.52 [−.72, −.31], ps < .001, respectively, which replicates prior work (Cimpian & Steinberg, 2014).

Effect on Is–Ought Inferences. As predicted, the manipulation also affected children's is–ought inferences: These inferences were weaker for facts explained extrinsically (M = .66, SD = .26) than for facts explained inherently (M = .74, SD = .21), $t(47) = 2.71$, $p = .009$, $d = .36$. This extrinsic vs. inherent difference remained significant when adjusting for children's age (in the full sample), β = −.15 [−.24, −.06], $p = .001$, and when jointly adjusting for children's age and the "shallow cues" control (in the relevant subsample), β = −.13 [−.25, −.002], $p = .046$. It is also interesting to note that the strength of children's is–ought inferences declined with age as well, βs = −.28 [−.46, −.09] and −.32 [−.55, −.07], ps ≤ .010, in the two models above, respectively.

Finally, we tested whether the effect of the explanation manipulation on children's is–

ought inferences was mediated by its effect on their intuitions about the necessity (vs. contingency) of the facts being explained. A bootstrapped product-of-coefficients multilevel mediation model, which also included children's age as a covariate, found evidence for the predicted indirect effect, *ab* = −.06 [−.12, −.01], *SE* = .03 (see Figure 2). This indirect effect remained significant when adding the "shallow cues" control as a covariate to the model, *ab* = −.05 [−.13, −.01], *SE* = .03. Thus, extrinsic explanations weaken children's is–ought inferences in part because they also weaken children's tendency to view the explananda as necessary and immutable.

Conclusion. We found that inherent (vs. extrinsic) explanations lead children to imbue reality with value. Given that children's explanations exhibit a strong inherence bias (e.g., Cimpian & Steinberg, 2014), these results suggest that explanatory biases might play an important role in the development of children's sociomoral reasoning, leading them to attach *shoulds* and *oughts* to an overly broad range of observed behavioral patterns.

Chapter 6

General Discussion

We proposed that the inherence bias in everyday explanations (e.g., Cimpian & Salomon, 2014a,b) leads people to view what is typical as also being good and desirable. Four studies provided correlational and experimental evidence for this proposal in participants spanning a broad range of development. These results provide new mechanistic insight into the common tendency to reason from *is* to *ought*, and they also identify a new, independent source of sociomoral value.

This work connects in potentially fruitful ways with other research in moral psychology. For instance, our studies suggest that people seem to move seamlessly from factual to value-based judgments, which is consistent with other studies that have found continuity between moral and nonmoral considerations in everyday reasoning (e.g., Cushman & Young, 2011; Knobe, 2010). Attending to the early-emerging link between explanatory biases and sociomoral judgments may also suggest answers to open questions in the developmental literature. We might predict, for example, that individual differences in children's inherence bias could help explain individual differences in drawing social-conventional vs. moral distinctions (e.g., Smetana et al., 2012): The stronger this bias, the more likely children might be to imbue even social-conventional regularities with quasi-moral force. In adults, individual differences in reliance on inherent explanations could also be part of the reason why some assign more value than others to tradition and custom (e.g., Eidelman & Crandall, 2014), and—relatedly—why issues of loyalty and respect for authority are central to sociomoral judgment for some more than others (e.g., Graham et al., 2013). Such areas of overlap and cross-fertilization further

highlight the theoretical contribution of these studies.

To conclude, the present research uncovers the psychological origins of a common judgment pattern that informs our evaluations of what is good and worthy, and that has been a central issue in moral philosophy since Hume (1740/2000). According to our evidence, the tendency to assign value to what is typical is due in part to a systematic bias in the process of explanation. Given that explanations fundamentally determine how we understand the world we inhabit, the influence of a bias in these judgments on our sociomoral evaluations may be substantial.

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Tables and Figures

Table 1

Sample Items from the Inherent Explanations Measure Used in Study 1

Sample Item
We use red in traffic lights to mean “stop” because of something about the color red or about stop lights—maybe the color red inherently acts as a warning.
We don’t keep chipmunks as pets because of something about chipmunks or about pets—maybe because chipmunks don’t like to be picked up or held.
We drink orange juice for breakfast because of something about orange juice or about breakfast—maybe the citrus aroma is refreshing and helps us to wake up.
Toothpaste is flavored with mint because of something about toothpaste or about mint—maybe the tingling sensation of mint makes one’s teeth and gums feel extra clean.
Dollar bills are green because of something about dollar bills or about the color green—maybe since green is the color of trees it symbolizes endurance and trust and thus was chosen for money.

Table 2

Multiple Regression Analysis Predicting Is–Ought Inferences from the Inherent Explanations Measure and the Control Variables in Study 1

Predictor	β	*t*	*p*
Inherent Explanations	.31**	3.27	.001
Education Level	–.07	–.80	.425
Raven's Progressive Matrices	–.02	–.24	.807
Conservatism	.10	1.14	.258
Belief in a Just World	–.09	–.93	.357
R^2 total	11.3%		
F	2.96*		
N	122		

* $p < .05$. ** $p < .01$.

Table 3

Multiple Regression Analysis Predicting Children's Is–Ought Inferences from the Inherent Explanations Measure and the Control Variables in Study 2

Predictor	β	*t*	*p*
Inherent Explanations	.43***	3.91	<.001
Chronological Age	.04	.38	.708
"Yes" Bias Control	.14	1.30	.196
R^2 total	22.3%		
F	7.26***		
N	80		

*** $p < .001$.

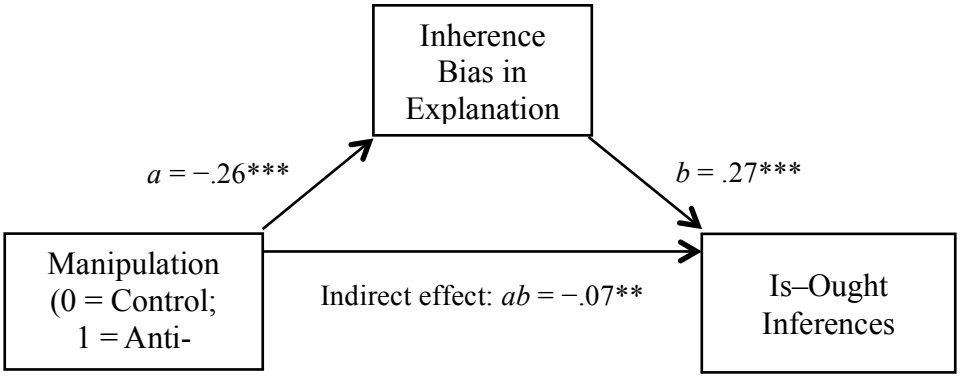

Figure 1. The effect of the experimental manipulation on participants' is–ought reasoning was mediated by a reduction in the inherence bias in their explanations (Study 3). The figure depicts standardized coefficients. $^{**}p < .01$. $^{***}p < .001$

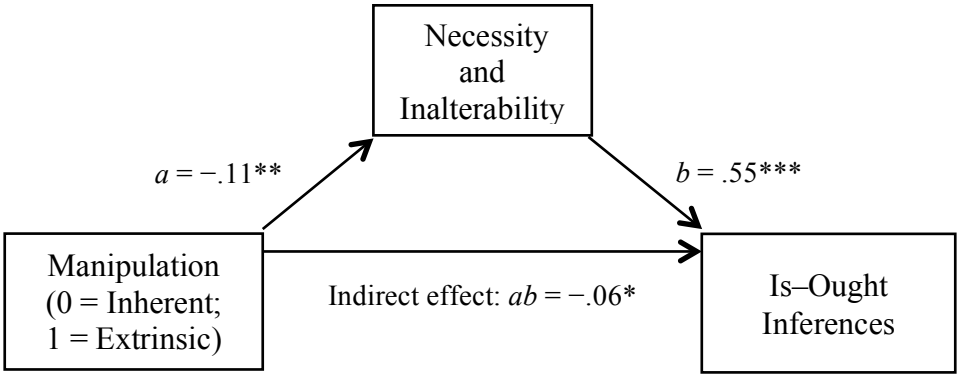

Figure 2. The effect of the inherent vs. extrinsic manipulation on children's is–ought reasoning was mediated by its effect on their intuitions about necessity and inalterability (Study 4). The model included children's age as a covariate. The figure depicts standardized coefficients. *p < .05. **p < .01. ***p < .001.

Appendix

Stimuli and Materials

STUDY 1 (ADULTS)

IS-OUGHT MEASURE

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PRESS RELEASE: NCA RELEASES 2013 COFFEE CONSUMPTION DATA

Coffee Consumption Jumps by 5%, 83% of Americans Say They Drink Coffee

San Francisco, CA (March 22, 2013) - Overall coffee consumption jumped by five percentage points this year, according to the NCA National Coffee Drinking Trends (NCDT) market research study. With this increase, 83% of the U.S. adult population now drinks coffee. At the same time, daily consumption remained strong and steady at 63%, while those who drink coffee at least once per week was up slightly to 75%. In other NCDT data, the single-cup brewing format continues to grow steadily: 13% of the U.S. population drank a coffee made in a single-cup brewer yesterday. This is up from just 4% in 2010. By contrast, past-day consumption of a coffee made in a drip coffee maker has dropped to 37% from 43% over the same period. Awareness of single-cup brewers reached 82%, up by 11 points from last year, while ownership has grown to 12% from 10% last year.

Target question:
- Do you think that it's good that so many Americans drink coffee?

Filler questions:
- Do you think the single cup brewing format is going to grow in the future?
- What do you think accounts for the success of the single cup brew?
- How far back do you think data has been collected on coffee consumption in the United States?
- What are your coffee drinking habits?

****

America's pizza obsession: By the numbers

U.S. pizza vendors sell the equivalent of 10 pies a year to every single man, woman, and child in the country

By The Week Staff | June 22, 2011

The quintessential American food may be apple pie, but its popularity pales beside our national love affair with pizza pies. *The Daily* reports that Americans consume a staggering 100 acres of pizza a day, according to data from the National Association of Pizza Operators (NAPO). Over $38 billion of pizza is sold in America annually, according to *Pizza Today*, and 3 billion pizzas are sold in the U.S. each year according to NAPO. 350 slices of pizza sold every second, according to NAPO, and the average American eats an average of 46 slices of pizza year, according to *Packaged Facts*. Overall, a total of 94% of Americans eat pizza.

Target question:
- Do you think it should be that so many Americans eat pizza?

Filler questions:
- Do you think the amount of pizza sold will grow in the next 5 years?

- What do you think accounts for the current prices of pizza?
- How far back do you think data has been collected on pizza consumption in the United States?
- What are your pizza consumption habits?

****

No Surprise: 64% of Americans Watch NFL Football; 73% of Men, 55% of Women
Written By Bill Gorman
NEW YORK, Oct. 14, 2011

/PRNewswire/ -- *Football Night in America* seems, at first, to be a presumptuous name for NBC to call their pre-game television program.
However, according to the results of a recent Adweek/*Harris Poll* the name is accurate as almost two thirds of U.S. adults say they currently watch NFL football (64%), including almost three quarters of men (73%) and over half of women (55%). These are some of the findings of a recent Adweek/*Harris Poll* survey of 2,374 U.S. adults surveyed online between September 9 and 13, 2011 by Harris Interactive. Despite all of the technology devices that Americans have come to use and rely on, the great majority of U.S. adults say that they watch NFL football on their television (60%) while fewer than one in ten say they watch on a desktop or laptop computer (8%), smart-phone (3%) or tablet computer (2%). Only 6% say they watch games live, as in they attend the games in person.

Target question:
- Do you think that it's good that so many Americans watch football?

Filler questions:
- Do you think the number of viewers who watch the games live will stay at around 6% over the next 5 years?
- What do you think accounts for why only 6% of football viewers watch the games live (that is, in person)?
- How far back do you think data has been collected on football viewership in the United States?
- What are your football viewing habits?

****

Americans still love to drive to work
June 13 2007, 5:04 PM EDT

An overwhelming majority of Americans skip the bus or forgo carpooling, choosing instead to drive to work, according to a government study published Wednesday. Nearly 9 out of 10 workers commuted to work by car in 2005, the Census Bureau revealed in its "American Community Survey". Today, a total of 88% of Americans drive to work. Conversely, only 4.7 percent of workers used public transportation to get to work, the survey found, with half of those workers found in the nation's largest cities like Boston, San Francisco, New York, Houston and Seattle. The Census Bureau study also revealed other interesting trends in Americans' commuting habits. Just 1 in 10 commuters carpooled to work, usually driving with just one other person in the car, according to the study. Portland, Ore., had the highest number of commuters who bicycled to work, with 3.5 percent of its workforce pedaling to work. As a nation, just 0.4 percent of the American workforce rode their bike to work in 2005.

Target question:
- Do you think that it's good that so many Americans drive to work?

Filler questions:
- Do you think the percentage of people who ride their bikes to work will continue to stay low over the next 5 years?
- What do you think accounts for why so few Americans ride their bikes to work?
- How far back do you think data has been collected on driving rates in the United States?
- What are your driving habits?

****

Americans Watching More TV Than Ever
By Swanni

Washington, D.C. (March 20, 2013) - The average American is now watching 23 hours of TV shows every week, compared to 21 hours in 2011 and 19 hours in 2010, according to a new study from Motorola Mobility. In addition, U.S. viewers are watching six hours of movies every week. Motorola, which has measured media activity for several years, says worldwide viewers watch an average of 19 hours of shows and movies a week, which is up from 10 hours in 2011. The study, which was based on surveys of 9,500 consumers in 17 countries, found that live TV viewing is still king with 73 percent of survey participants saying they watch it when it airs. 99 % of American households own a TV. But DVR owners watch an average of one hour more programming each week. The increase in TV viewing in the U.S. and worldwide can be attributed at least in part to the growing number of available devices and services that can display both live and recorded video. Viewers can now watch live and/or traditionally scheduled programming on their big-screen TVs; recorded shows from their DVRs; and both live and recorded content from mobiles such as the iPad and iPhone.

Target question:
- Do you think it should be that so many American households own a TV?

Filler questions:
- Do you think the average number of shows and movies that Americans watch per week will continue to grow over the next 5 years?
- What do you think accounts for the growing number of available devices to watch videos?
- How far back do you think data has been collected on TV viewing in the United States?
- What are your TV viewing habits?

****

Search and email still top the list of most popular online activities
Aug 9, 2011
by Kristen Purcell

A May 2011 Pew Internet survey finds that 92% of online adults use search engines to find information on the Web, including 59% who do so on a typical day. This places search at the top of the list of most popular online activities among U.S. adults. But it is not alone at the top. Among online adults, 92% use email, with 61% using it on an average day. According to the Pew Internet Project, these two behaviors have consistently ranked as the most popular in the last decade. Even as early as 2002, more than eight in ten online adults were using search engines, and more than nine in ten online adults were emailing. Of course, the internet population has grown substantially since 2002. So, the overall number of users of both email and search engines has also grown. In January 2002, 52% of all Americans used search engines and that number grew to 72% in the most recent survey. In January 2002, 55% of all Americans said they used email and that number grew to 70% in the current survey.

Target question:
- Do you think it should be that so many Americans use email?

Filler questions:
- Do you think the overall population of internet users will continue to grow in the next 5 years?
- What do you think accounts for the recent rise in the population of internet users?
- How far back do you think data has been collected on email and internet search use in the United States?
- What are your email and internet search habits?

STUDY 2 (CHILDREN)

MOCK NEWSPAPER

University of Illinois at Urbana-Champaign March 29, 2013

Breaking News! Read all about it!

The Daily Illini

Brides wear white at weddings!

Brides wear white wedding dresses. Wedding dresses come in all sorts of shapes and sizes, but they are always white. When you look at pictures from a wedding, the bride is always wearing a white dress.

Boys wear pants!

Boys wear pants. Pants come in all sorts of colors, but boys often wear them. When you see boys at school, they are often wearing pants.

University of Illinois at Urbana-Champaign March 29, 2013

Breaking News! Read all about it!

The Daily Illini

Dads have short hair!

Dads have short hair. Dads' hair can be curly or straight, brown or blonde, but it is almost always short. When you see Dads walking around, they have short hair.

Money is green!

Most paper money in America is green. Paper money comes in 1-dollar bills, 5-dollar bills, and 10-dollar bills, but it is always green. When you see people pay for stuff, they use green money.

STUDIES 2 & 4 (CHILDREN)

IS-OUGHT MEASURE & CONTROL QUESTIONS

Is–Ought Questions (Studies 2 & 4) (using the "brides wear white at weddings" fact)

Question 1: Do you think it is good that brides wear white at weddings, and not a different color, like yellow? Do you think it's good that brides wear white at weddings?

If child said "yes": Do you think it's sort of good, good, or really good that brides wear white at weddings?[1]

Scoring: 4-point scale (1 = "no" to 4 = "really good")

Question 2: What if brides did wear yellow to weddings? Would that be bad?

If child said "yes": Do you think it would be sort of bad, bad, or really bad if brides wore yellow to weddings?[1]

Scoring: 4-point scale (1 = "no" to 4 = "really bad")

Question 3: Remember how we read that brides wear white at weddings, and not a different color, like yellow? Is that the way that things should be? Brides wearing white?

Scoring: 0 = "no", 1 = "yes"

"Yes" Bias Control Question (Study 2) (using the "brides wear white at weddings" fact)

Do you think it's interesting that brides wear white at weddings, and not a different color, like yellow? Do you think it's interesting that brides wear white to weddings?

If child said "yes": Do you think it's sort of interesting, interesting, or really interesting that brides wear white to weddings?[1]

Scoring: 4-point scale (1 = "no" to 4 = "really interesting")

"Shallow Cues" Control Question (Study 4) (using the "brides wear white at weddings" fact)

Do you think it's fun that brides wear white at weddings?

If child said "yes": Do you think it's sort of fun, fun, or really fun that brides wear white to weddings?[1]
If child said "no": Do you think it's sort of not fun, not fun, or really not fun that brides wear white to weddings?[1]

Scoring: 6-point scale (1 = "really not fun" to 6 = "really fun")

[1] These questions were accompanied by a visual scale consisting of three circles of increasing size. Children could use this scale to respond non-verbally if they wished (i.e., by pointing to a circle).

STUDY 4 (CHILDREN)

INHERENT VS. EXTRINSIC EXPLANATION MANIPULATION

Fact: Brides wear white at weddings

Inherent: I read a book a while ago about this, and it said that brides wear white just because there's something about white that makes it go with weddings. It's because it's really bright and so it makes people happy. Also, white helps make the bride stand out and so everyone is looking at her at the wedding. So brides wear white wedding dresses! Interesting, huh? I guess there are real reasons why brides wear white. It's not like it's something that happened by accident. There's just something about white that explains why brides wear white at weddings.

Extrinsic: I read a book a while ago about this, and it said that brides wear white just because of something that happened a long time ago. It's because a really important Queen wore white all the time—and of course she wore white to her wedding too! So she just decided to wear a white dress to her wedding. After that, lots of brides started wearing white wedding dresses to look like the Queen—even though they could have gotten them in other colors, and even when the Queen wasn't around anymore! Interesting, huh? I guess there's no real reason why brides wear white. It's not like there's anything special about white that makes it go with brides. It's just because of something that happened a long time ago that brides wear white at weddings.

Fact: Boys wear pants

Inherent: I read a book a while ago about this, and it said that boys wear pants just because there's something about pants that makes them go with boys. It's because pants are easy to play sports in and boys play a lot of sports. Also, pants help boys move around and so boys can use all of their energy. So boys wear pants! Interesting, huh? I guess there are real reasons why boys wear pants. It's not like it's something that happened by accident. There's just something about pants that explains why boys wear them.

Extrinsic: I read a book a while ago about this, and it said that boys wear pants just because of something that happened a long time ago. It's because a well-known General was the first person to start wearing pants—he owned so many pants and that is all he wore! So he just decided that he wanted to wear pants. After that, lots of boys starting wearing pants to look like the General—even if there were other things to wear, and even when the General wasn't around anymore! Interesting, huh? I guess there's no real reason why boys wear pants. It's not like there's anything special about pants that makes them go with boys. It's just because of something that happened a long time ago that boys wear pants.

Fact: Dads have short hair

Inherent: I read a book a while ago about this, and it said that Dads have short hair just because there's something about short hair that makes it go with Dads. It's because short hair fits under hats and Dads wear hats all the time. Also, short hair helps Dads keep hair out of their face when it's windy. So Dads have short hair! Interesting, huh? I guess there are real reasons why Dads have short hair. It's not like it's something that happened by accident. There's just something about short hair that explains why Dads wear their hair like that.

Extrinsic: I read a book a while ago about this, and it said that Dads have short hair just because of something that happened a long time ago. It's because a really famous singer cut his hair short—his picture was in lots of famous magazines so everyone saw his hair! So the singer just decided to cut his hair short. After that, lots of men started cutting their hair short to look like the singer—even though there were other hairstyles, and even when the singer wasn't around anymore! Interesting, huh? I guess there's no real reason why Dads have short hair. It's not like there's anything special about short hair that makes it go with dads. It's just because of something that happened a long time ago that Dads have short hair.

Fact: Money is green

Inherent: I read a book a while ago about this, and it said that money is green just because there's something about the color green that makes it go with money. It's because it's easy to see and so it's easy to use when you pay for stuff! Also, green helps money look different from other paper so people don't get confused. So money is green! Interesting, huh? I guess there are real reasons why money is green. It's not like it's something that happened by accident. There's just something about the color green that explains why money is green.

Extrinsic: I read a book a while ago about this, and it said that money is green just because of something that happened a long time ago. It's because an important businessman closed his eyes and picked a color out of a hat [close eyes and motion picking out of a hat]—there were lots of colors in the hat, and he happened to pick green! So he just decided to use green for money. After that, people kept making money green like the businessman picked—even when there were lots of other colors, and even when the businessman wasn't around anymore! Interesting, huh? I guess there's no real reason why money is green. It's not like there's anything special about green that makes it go with money. It's just because of something that happened a long time ago that money is green.

Fact: School buses are yellow

Inherent: I read a book a while ago about this, and it said that school buses are yellow just because there's something about the color yellow that makes it go with school buses. It's because it makes people in cars pay attention and so they drive safely around the school bus! Also, yellow helps kids see that their school bus is close when they wait at the bus stop. So buses are yellow! Interesting, huh? I guess there are real reasons why school buses are yellow. It's not like it's something that happened by accident. There's just something about the color yellow that explains why school buses are yellow.

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Extrinsic: I read a book a while ago about this, and it said that buses are yellow just because of something that happened a long time ago. It's because an important person in charge of schools wanted to paint the first school bus yellow—she picked yellow because she had lots of yellow flowers in her yard, and she really liked them. So she just decided to make buses yellow! After that, lots of people kept making buses yellow like the person picked—even though they could have gotten other paint, and even when the person who picked yellow wasn't in charge of schools anymore! Interesting, huh? I guess there's no real reason why buses are yellow. It's not like there's anything special about yellow that makes it go with buses. It's just because of something that happened a long time ago that buses are yellow

Fact: Birthday cakes have candles

Inherent: I read a book a while ago about this, and it said that birthday cakes have candles just because there's something about candles that makes them go with birthday cakes. It's because you can put as many as you need on your birthday cake, and so they're easy to count your years on! Also, candles help birthday cakes look bright and colorful which makes people happy. So birthday cakes have candles! Interesting, huh? It's not like it's something that happened by accident. I guess there are real reasons why birthday cakes have candles. There's just something about candles that explains why birthday cakes have them.

Extrinsic: I read a book a while ago about this, and it said that birthday cakes have candles just because of something that happened a long time ago. It's because an important President had a friend who was a candle maker— his friend gave him so many candles and he needed something to do with them. So he decided to put them on birthday cakes! After that, lots of people started putting candles on birthday cakes to be like the President—even though they could have put something else on them, and even when the President wasn't around anymore! Interesting, huh? I guess there's no real reason why birthday cakes have candles. It's not like there's anything special about candles that makes them go with birthday cakes. It's just because of something that happened a long time ago that birthday cakes have candles.